

## Statistical Issues for Calculating Reentry Hazards

Mark Matney  
Orbital Debris Program Office  
NASA Johnson Space Center  
Houston, TX  
USA

John Bacon  
Orbital Debris Program Office  
NASA Johnson Space Center  
Houston, TX  
USA

A number of statistical tools have been developed over the years for assessing the risk of reentering object to human populations. These tools make use of the characteristics (e.g., mass, shape, size) of debris that are predicted by aerothermal models to survive reentry. This information, combined with information on the expected ground path of the reentry, is used to compute the probability that one or more of the surviving debris might hit a person on the ground and cause one or more casualties.

The statistical portion of this analysis relies on a number of assumptions about how the debris footprint and the human population are distributed in latitude and longitude, and how to use that information to arrive at realistic risk numbers. This inevitably involves assumptions that simplify the problem and make it tractable, but it is often difficult to test the accuracy and applicability of these assumptions.

This paper builds on previous IAASS work to re-examine many of these theoretical assumptions, including the mathematical basis for the hazard calculations, and outlining the conditions under which the simplifying assumptions hold. This study also employs

empirical and theoretical information to test these assumptions, and makes recommendations how to improve the accuracy of these calculations in the future.